

## Research Article

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# Negative Affect and Situational Antecedents of Eating in Disordered Eating and Normal Population an Ecological Momentary Assessment Study

Paganini C<sup>1\*</sup>, Peterson G<sup>1</sup> and Mills J<sup>2</sup>

<sup>1</sup>Faculty of Health, University of Tasmania, Sandy Bay Campus, Australia

<sup>2</sup>School of Psychology, the Cairnmillar Institute, Australia

**\*Correspondence:** Chiara Paganini, Faculty of Health, University of Tasmania, Sandy Bay Campus, Churchill Ave, Sandy Bay, 7005, Australia, E-mail: chiara.paganini@utas.edu.au

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## Abstract

The research examined the role of an affective state and immediate surrounds as possible antecedents of eating, utilising Ecological Momentary Assessment (EMA), repeated assessments of current psychological and situational states in participants' natural environments. 136 adults [55 with disordered eating (DE) and 81 controls] were recruited from the community and they completed event-contingent and random assessments over a seven-day period. Psychological and situational variables relative to eating were investigated to test if there was a significant difference in negative affect, hunger levels, time and location. To account for the nesting of multiple categorical observations within subjects, data were analysed using generalised estimating equations and autoregressive correlation, a repeated measure MANOVA and paired-sample *t*-tests. Levels of guilt and disgust were higher at eating episodes in DE participants and feelings of guilt and dissatisfaction with self were higher after eating. Being at home and being alone were both found to act as antecedents for eating in DE, whereas controls were more likely to eat whilst out in social situations. The affective state of an individual and their surrounding context, appear to be integral to the eating patterns of individuals with DE.

**Keywords:** Eating, Disordered eating, Negative affect, Antecedents, Ecological momentary assessment

## Introduction

Disordered Eating (DE) refers to a range of unhealthy behaviours that occur at a lesser frequency, or lower level of severity, than an eating disorder. Even though the symptoms of DE might not be as extreme as those of a diagnosable eating disorder, individuals with DE are at increased risk of developing a full-blown eating disorder and are more likely to suffer of depression and/or anxiety and other mental health problems [1,2].

Extant literature appears insufficient in investigating DE in normal population, but a number of studies have found that certain psychological factors (i.e., low self-esteem [3], negative affect [4,5], impulsivity [6]) and

contextual factors (i.e., eating with or without other people [7]) might increase the risk of DE [8]. However, these risk factors are often studied individually and little is known about how they might interact. In accordance with the biopsychosocial model, the present research explores psychological factors (i.e., negative affect) and situational factors (i.e., immediate context and situations of eating) in predicting eating patterns in normal eaters and individuals with DE [9].

Negative affect, or the experience of an aversive mood state, seems to play an important role in eating pathology [5,10-13]. Literature confirms that the highest rate of binge eating and purging episodes occurs on days characterised by high levels of negative affect [14-16].

Interestingly, the increase in food intake in response to negative emotions has been found among normal eaters as well [17]. This suggests that the link between negative affect and eating is not unique to those with clinically significant levels of eating disorder symptomatology [18].

Unfortunately, research on the role of negative affect in eating pathology is limited by the fact that negative affect is a broad umbrella term encompassing multiple facets and many types of emotional experiences with numerous different methods of assessment [15,19-22]. The results of these studies are relatively inconsistent, showing both an increase in negative affect prior to eating [12], whilst others demonstrate increased negative affect after eating [10,11], and others still show a decrease in negative affect after eating [21].

On the other hand, research has shown that not only negative affect, but also the specific context or setting surrounding an individual, might influence eating behaviours [23]. Eating in restaurants/café's, eating with others, and consuming alcohol while eating have all been shown to increase food consumption [7,23,24].

Other studies suggest that time might also influence eating patterns. There is evidence showing that people change their eating patterns on weekends compared to weekdays [25]. Moreover, people seem to eat more in the evening [26] due to fatigue and fewer self-control resources being available [27].

In addition, the presence of others has been shown to affect what and how much people order or serve themselves initially, as well as what and how much they end up consuming [28]. Research on the social facilitation of eating shows that people generally eat more food with other than those eating alone<sup>23</sup>. Additionally, the more people present, the more everyone eats [29].

Other studies showed that eating behaviours might also be affected by cohabitation status and absence of others. People living alone are less likely to have an opportunity to eat with others and this might have an impact on the amount of food eaten [30]. Tani et al. [31] showed that eating alone was associated with unhealthy dietary behaviours in both men and women and was associated with obesity and depression [32].

The present research has the aim of investigating DE considering the conjunction of two different factors [9]: 1) psychological factors, specifically, negative affect [15,19],

and 2) situational factors, namely, the immediate context (location, time and presence/absence of others) [29]. In order to address this aim, this study uses ecological momentary assessment (EMA; also referred to as experience- or event- sampling, or diary methods). EMA is recommended for investigating the antecedents of any repeated behaviour over time and is well-established as a methodology for capturing eating, mood, and context [5,10,33-35].

The current study hypothesises that: 1) negative affect will be more likely to precede an eating episode in the disordered eating sample compared to normal eaters [15,19], and 2) being in a familiar environment and in absence of others (i.e., being at home alone) will be antecedents of eating in the disordered eating sample [30,31].

## Materials and Method

### Participants

To be included in the final sample, participants needed to 1) be able to read and write in English, 2) be willing to give their consent to and complete the research tasks, 3) be over 18 years old and 4), if female, not be pregnant. Of the 179 participants who completed the questionnaires, 136 participants met the criteria.

The final sample consisted of 55 individuals with disordered eating (DE) and 81 healthy controls. The presence or absence of DE was determined using the cut off score of 2.50 for the EDE-Q6. The majority of the participants were female ( $n_{\text{female}} = 90$ ;  $n_{\text{male}} = 46$ ), between an age range of 18 to 43 years (median = 29 years). The majority of the sample was Caucasian, with 85 (62.5%) participants identifying as such, 16 (11.8%) as Asian, 15 (11%) as Black or Africans, 7 (5.1%) as Middle Eastern, and 13 (9%) as other ethnicities or Aboriginal. Fifty-seven (41.9%) participants had completed tertiary education, 53 (37.5%) had completed postgraduate studies, 18 (13.2%) had completed secondary studies and 8 (5.9%) had completed primary studies. Results showed that controls did not significantly differ from the DE group in terms of age and body mass index (BMI). The median age was 29 years old and the median BMI was 21.45 in both groups.

### Measures

#### Screening measures

**Eating disorder symptomatology:** The Eating Disorders Examination Questionnaire (EDE 6.0; [36]) is a 28-item questionnaire based off the full-length,

semi-structured EDE interview [37]. Acceptable levels of internal consistency were observed, with a Cronbach's alpha of .967 for the global EDE-Q, and a range from .951 (Shape Concern Scale) to .964 (Weight Concern Scale) for the individual subscales. With a cut-off score of 2.30 [38,39], the EDE-Q6 effectively discriminates between patients who might present a disordered eating pattern and normal controls [40,41].

### Eating-prompted EMA assessments

**Eating experience:** Participants recorded every eating episode, indicating the type of meal (breakfast, morning snack, lunch, afternoon snack, dinner, and not applicable/random eating). The subjective perception of the amount of food eaten was assessed by asking "How much have you eaten?", to which participants could respond with either "Too much", "Adequate", or "Not enough". Participants were also asked to indicate the perceived loss of control during the episode by responding to "Did you lose control?" with "Yes" or "No". These items allowed us to discriminate a binge episode from a normal overeating episode [42]. Participants were also asked to indicate their subjective level of hunger using a scale from 0 to 100.

**Negative affect:** Six items from the PANAS X were chosen to assess the following momentary negative affective states: dissatisfaction with self, ashamedness, disgust, anger, loneliness, and guilt. Participants were asked to rate the extent to which they currently felt each of these emotions at that moment on a continuous scale, ranging from 0 (*Not at all*) to 100 (*Extremely*). The internal consistency of this abbreviated negative affect scale was strong ( $\alpha = .87$ ), which is consistent with the full PANAS-X when assessed at the momentary level (range of  $\alpha = .85-.91$ ; [43]).

**Context:** In order to assess the specific situation during the episode, participants responded to three items, based off Stein et al. [44]. First, participants were asked to indicate what kind of activity they were currently engaging in, where 1 = Resting/relaxing, 2 = Socialising, 3 = Working, 4 = Exercising, and 5 = Other). Second, participants indicated if they were alone or with others, where 1 = Alone, 2 = Partner, 3 = Friends, 4 = Family, 5 = Co-workers, and 6 = Others. Lastly, participants provided their location, where 1 = Home, 2 = Car, 3 = Restaurant/cafe, 4 = Work/School, 5 = Outside, and 6 = Other).

**Random EMA assessments:** In order to record non-eating episodes, level of hunger, negative affect, and

immediate context (total of 10 items) were all assessed using the same items as above, at random time points.

### Procedure

This study was approved by the University of Tasmania Research Ethics Board. Participants with disordered eating ( $N = 55$ ) and healthy controls ( $N = 81$ ) were recruited from Medical Clinics (i.e., Brunswick Central Medical Centre, Georgy Medical Clinic, Sia Medical Clinics and Werribee Health Care Group Medical Clinics), eating disorders clinics and associations (i.e., Eating Disorders Victoria and Butterfly Foundation), and from the campus and surrounding community populations of University of Melbourne. Recruitment methods included posters and advertisements (both online and hard copy) that invited men and women to participate in a study of their daily eating experiences. Every site used identical protocols for recruitment, screening, and data collection.

Interested participants completed an online eligibility screen through a Qualtrics website (<http://www.qualtrics.com/>), where they received additional information about the research. They were asked to complete the consent form and the Eating Disorder Examination Questionnaire (EDE-Q6). If the individual was deemed eligible, a confidential email was sent which contained a link to a website where participants could register themselves and download the online application called RAEating for the EMA component on a desktop, iOS, or Android application. The EMA questionnaires and alarm mechanisms were developed in Hypertext Preprocessor (PHP), with the support of the Code Igniter (<http://codeigniter.com/>) framework, to leverage its security and database abstraction features, with the highest priority being the security of the system. All the user data was stored in a MySQL table, one of the most commonly used RDBMS databases.

Participants were invited to complete EMA protocols on their personal device for the duration of one week. Participants were prompted to enter data through a form with either a touch-based interface (on touch-capable mobile devices) or through mouse/keyboard interaction. The study involved two types of EMA protocols: 1) event-contingent, where participants were instructed to complete an assessment whenever they were eating, and immediately after eating, which took approximately 2-3 minutes to complete, 2) random, where participants received a push notification or desktop notification at random points (approximately once every three hours during waking hours, resulting in a total of 5-6 alarms per

day) to capture non-eating experiences. Each of these random assessments took approximately 1-2 minutes to complete. Answers were collected as alphanumerical values, acting as keys for the questions/answers pairs outlined in the EMA protocol file. All the users' data were stored in a MySQL database.

If the participant did not respond within two minutes after the alarm sounded, the application provided the option to "snooze" (the alarm would sound five minutes later), "skip" (the missed alarm was recorded), or "answer" (participants responded). Participants could turn off the audible alarm for short periods of time (up to a maximum of two hours) during the day when it might be dangerous (e.g., driving) or inappropriate to respond. The alarms resumed automatically after two hours. For all of the random entries, participants were asked if they were in the middle of eating. If so, the reading was terminated.

### **Data analytic strategy**

Frequency and descriptive statistics were obtained for the demographic data, EDEQ-6, and EMA protocol. Several of the variables under investigation were not normally distributed; hence, descriptive statistics are represented by median and percentage.

Firstly, a two-level confirmatory factor analysis with random intercept was performed on the EMA data to evaluate the factor structure of the PANAS-X and Stein negative affect scale.

Secondly, a within-subject design was adopted to address whether antecedent conditions varied in disordered eating participants and in controls. The individual observations, i.e., the self-initiated participant EMA entries and non-eating alarm entries, were the unit of analyses.

To account for the nesting of multiple categorical observations within subjects, data were analysed using logistic generalised estimating equations (GEE) with a binary logit link function and autoregressive correlation. A square root transformation of the variables was performed to improve normality. The results of GEE using the variables remained significant prior to, and following, the transformation of the data; so, untransformed data are presented. To offset issues of collinearity and to preserve power, separate models were run for each independent variable. The robust covariance estimator was used to correct for underestimation of standard errors, thus reducing Type 1 error.

Thirdly, a repeated measure MANOVA and paired-sample *t*-tests were performed to test if there was a significant difference in the level of negative affect at the time of eating and afterwards in the disordered eating sample. All assumptions of linearity, homogeneity of variance-covariance matrices, and the absence of multicollinearity were met, and there were no univariate or multivariate outliers. Positively and negatively skewed variables were transformed to improve normality. Analyses were conducted with SPSS version 22.

## **Results**

### **Baseline Measures**

There was a significant difference between the disordered eating group and the control group in the distribution of male ( $N = 46$ ) and female ( $N = 90$ ) participants,  $p = .039$ . Results indicated that the control group displayed higher levels of education than the DE group (Education  $p = .001$ ).

To assess the level of disordered eating, EDE-Q6 total scale (EDE-total) and subscales (restraint, eating concerns, shape concerns, and weight concerns) were calculated for all participants. Due to the violation of normality, the median, range and Mann-Whitney U test were calculated. As expected, the disordered eating group had significantly higher scores on the EDE-Q6 total scale (median = 3.7, range = 2.6 - 5.6) compared to controls (median = 1.5, range = 1 - 2.26),  $p < .001$ .

Regarding the frequency of specific DE behaviours in the DE sample over the past four weeks, 20% was dieting every day; fasting (for eight waking hours or more) was displayed by 21.8% of the sample at least 16 days in the last four weeks. 18% was excluding food from their diet every day, and 23.6% applied rules about food (e.g. eating a certain number of calories) at least 23 of the past 28 days. Moreover, 22.2% and 25.5% desired to have an empty and flat stomach at least 16 and 13 days in the last four weeks, respectively. Of the total sample, 20.4% reported thinking about food every day and 26.4% thought about weight and shape at least 6 days in the previous four weeks. Over 20% reported feeling scared of losing control over food every day for the past four-week period, 24.1% had a constant fear of gaining weight, while 32.1% felt constantly fat. More than 50% had episodes of overeating between 1 and 5 days per month, while 60.8% was scared to lose control over food between 1 and 5 days per month. The majority of the sample did not display purging episodes, laxative misuse, or compulsive exercising.

## Confirmatory factor analysis

The CFA indicated that the best-fitting model was a three-factor solution (RMSEA = .024; CFI = .950; TLI = .960) that replicated the results of the original factor analysis: Guilt (ashamed, guilty, dissatisfied), Hostility (angry, disgusted) and Sadness (lonely) (Watson & Clark, 1994). Cronbach's alphas of the negative affect subscale were .82 (Guilt), .83 (Hostility), and .84 (Sadness), demonstrating good internal consistency. Model estimates from the CFA demonstrated significant, moderate associations among the three factors, which was expected, given that they represent sub-factors of a global NA scale. Finally, Factor  $\times$  Time interactions were not significant, indicating that the model structure did not vary over the 1-week assessment period.

## Psychological and situational antecedents

Results indicated that DE participants were more likely to eat when feelings of disgust (OR = .998 [.996 - 1.000]) and guilt (OR = .992 [.989 - .995]) were elevated compared to non-eating episodes. On the other hand, the control sample showed that only hunger (OR = .996 [.992 - .999]) was higher during an eating episode compared to a non-eating episode.

Regarding situational antecedents, the DE group was more likely to eat at home (OR = .847 [.753 - .952]) and when they were alone (OR = .883 [.786 - .993]). They reported a statistically significant reduction of eating when they were engaging in physical (OR = 5.870 [4.468 - 7.712]) and social (OR = 1.145 [1.007 - 1.302]) activities, or when they were outdoors (OR = 1.661 [1.272 - 2.168]) and among strangers (OR = 3.990 [3.125 - 5.094]). On the other hand, the control group reported significantly more eating episodes at restaurants/pubs/cafes (OR = .482 [.286 - .811]), at work/school (OR = .469 [.273 - .808]), and with co-workers or students (OR = .665 [.388 - 1.140]) compared to a significant reduction of eating episodes when exercising (OR = 5.467 [2.655 - 11.257]; Table 1).

Negative affect ratings whilst eating and post-eating were compared across DE participants to assess the antecedences of eating. A repeated-measures MANOVA indicated a statistically significant difference in eating and post-eating scores (Wilks'  $\lambda$  = .132,  $p$  = < .001) for feelings of dissatisfaction ( $p$  = .007) and guilt ( $p$  = .003). For the control group, a repeated-measure MANOVA indicated a non-significant difference in eating and post-eating scores for all the variables under investigation (Table 2).

## Discussion

The current study aimed to explore the possible proximal impact of both negative affect and situational factors on behavioural aspects of eating in DE and normal eaters, through the use of EMA.

Results showed higher levels of negative affect and more frequent loss of control over eating in DE participants compared to controls. In particular, the DE group reported significantly higher levels of shame, disgust, loneliness, anger and guilt than controls. Furthermore, disordered eating participants were more likely to eat when feelings of disgust and guilt were elevated. This seems to indicate that feelings of guilt and disgust could act as antecedents of eating [5,10,15]. The immediate consequence of eating was a general decrease of negative affect, with significant results for the level of dissatisfaction and guilt [15].

Results showed that, among DE participants, eating episodes were most likely to occur when participants were at home by themselves [30,31], and less likely to occur during physical activity and whilst being outdoors. Individuals in the control group were more likely to eat at restaurants/cafés, and with colleagues or other students, and less likely to eat during physical activity and whilst being outdoors [45].

Regarding contextual triggers for eating, the control and DE showed different trends. For the control group, eating, even in larger quantities, occurred when they were feeling good, in the evening, at restaurants, and with family and friends [45]. On the other hand, the DE group showed an association with negative affect and eating in certain situations, specifically, being at home and being alone. These findings suggest that the inherent nature of certain situations might be responsible for increasing specific facets of negative affect, for example, feelings of loneliness [31]. This finding aligns with those of Levine [46] and Tani [31], who argue that there is an enduring association between absence of others and DE.

Overall, the present study confirmed the importance of individual difference factors, such as negative affect, and situational factors, such as familiar location, and absence of others in disordered eating [32,46]. In particular, it seems that individuals who engage in DE tend to use food in situations where they experience high levels of negative affect, and are without others to socialise and interact with, possibly for comfort or coping purposes [8]. As such, this was the first study to demonstrate that there are within-person situational processes in disordered

**Table 1:** Antecedents of eating and not eating episodes in control group (81 participants) and DE.

Variables	DE (55)			Controls (81)		
	Eating occasions M (SD)	Non eating occasion M (SD)	OR(95% CI)	Eating occasion	Non eating occasion	OR(95% CI)
NA variables						
Hunger	26.72(22.70)	25.32 (22.47)	.999 (.997-1.001)	24.11 (19.13)	22.55 (20.36)	.996 (.992-.999)*
Dis satisfaction	34.20 (30.11)	32.90 (29.15)	1.000 (.998-1.002)	20.14 (24.67)	21.26 (24.79)	1.001 (.999-1.003)
Shame	57.66 (29.78)	53.64 (30.67)	.997 (.996-.999)	17.02 (22.52)	18.37 (24.00)	1.002 (1.000-1.004)
Disgust	29.90 (26.71)	25.57 (24.40)	.998 (.996-1.000)***	18.76 (21.81)	20.04 (22.08)	1.002 (1.000-1.004)
Anger	26.22 (26.26)	24.54 (23.63)	1.000 (.998-1.002)	19.52 (22.52)	19.43 (21.87)	.999 (.998-1.001)
Lonely	22.52 (23.52)	21.05 (22.71)	1.001 (.998-1.003)	13.40 (18.15)	13.42 (18.15)	.999 (.997-1.001)
Guilt	25.20 (24.00)	18.77 (18.36)	.992 (.989-.995)****	14.12 (16.40)	14.39 (16.83)	1.000 (.997-1.003)
Situational variables						
Resting	27.5	20	1.27 (.82-1.96)	25.2	22.5	.831 (.457-1.512)
Socialising	25.5	28.8	1.14 (1.00-1.3)*	31.3	28.4	.809 (.412-1.588)
Working	40.6	32.8	1.063 (.94 -1.200)	38.9	33.6	.834 (.460-1.513)
Exercising	1.4	20.3	5.870 (4.468-7.712)****	2	12.6	5.467(2.655-11.257)****
Other	2.1	1	.787 (.510-1.215)	2.6	2.9	1.203 (.661-2.190)
Home	37.6	31.5	.847 (.753-.952)***	35.7	32.6	.522 (.312-.872)
Car	2.4	1.2	.737 (.517-1.051)	2.7	2.9	.578 (.317-1.054)
Restaurant/ Café'	21.9	19.4	1.034 (.894-1.197)	24.3	21	.482 (.286-.811)***
Work/ School	32.6	26.5	.975 (.861-1.104)	32	27.8	.469 (.273-.808)***
Outdoor	3.4	6.5	1.661 (1.272-2.168)****	3.6	6.2	.742 (.429-1.284)
Others	1.5	14.9	4.338 (3.360-5.601)****	1.8	9.6	1.915 (1.146-3.200)***
By myself	31.7	27.5	.883 (.786-.993)*	26.5	24	.603 (.359-1.013)
With partner	7.2	7	1.076 (.854-1.356)	10.1	10.1	.649 (.376-1.121)
With friends	13.6	12.7	1.050 (.878-1.255)	16.8	17.3	.646 (.392-1.064)
With family	3.6	4.5	1.245 (.964-1.606)	5.1	4.2	.603 (.350-1.041)
With co workers	42.1	33.2	.943 (.833-1.068)	39.7	34.8	.665 (.388-1.140)*
With others	1.8	15.1	3.990 (3.125-5.094)****	1.8	9.5	1.659 (.988-2.787)

\* p &lt; .05. \*\*\* p &lt; .001. \*\*\*\*p &lt; .0001

eating, related to the absence of other people and being in familiar locations acting as unique antecedents of disordered eating.

**Table 2:** Comparing eating and post-eating ratings in DE (n=55).

	<b>Eating M (SD)</b>	<b>Post M (SD)</b>	<b>t</b>	<b>p</b>
Hungry	24.72 (19.02)	25.06 (23.27)	-2.309	0.084
Dissatisfied	51.73 (29.32)	31.20 (29.21)	6.047	0.007
Ashamed	46.98 (29.77)	49.49 (29.40)	-3.052	0.193
Disgusted	28.57 (24.49)	30.13 (27.07)	-4.387	0.113
Angry	31.97 (28.04)	25.23 (25.83)	2.601	0.051
Lonely	34.11 (30.02)	30.53 (21.61)	5.68	0.733
Guilty	27.76 (24.77)	24.76 (23.85)	-1.463	0.003

## Limitations and Implications

First of all, the EMA component lasting only 7 days may have led to some eating experiences being missed. A second limitation is that although this study assessed participants' eating patterns within everyday life, it did not assess which kind of specific DE behaviours the participants were engaging in throughout the day, such as purging, bingeing, or restriction.

The findings from the study at hand could have important implications for developing new psychological treatments that direct more attention to affect regulation strategies. Psycho-educational prevention and intervention programs could educate at-risk individuals about the transient utility of DE in reducing negative affect. It is also apparent from these findings that individuals who engage in disordered eating would also likely benefit from programs that aim to teach skills and strategies around reducing distress and improving tolerance for each specific antecedent and trigger of DE, such as, being at home or being alone [47].

## Conclusion

The findings indicate that experiencing feelings of dissatisfaction with oneself and guilt [15], along with being alone [46], and being in a familiar place [29], play an important role in precipitating eating behaviours, highlighting that the affective state and social environment of an individual may be key in the onset and/or maintenance of DE. As a result of identifying specific antecedents to problematic eating patterns, our ability to inform the development of more targeted prevention and intervention strategies for both sub-clinical and

clinical individuals is enhanced.

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